

LC 2016 (SET A): PAPER 2

QUESTION 7 (55 MARKS)

Question 7 (a)

Number in Scientific notation:

$$a \times 10^n, n \in \mathbb{Z}, 1 \leq a < 10$$

$$\begin{aligned} &165 \text{ billion} \\ &= 165\,000\,000\,000 \\ &= 1.65 \times 10^{11} \end{aligned}$$

Question 7 (b)

(i) Diameter (d) = $2 \times$ Radius (r)
 $d = 18 \text{ m} \Rightarrow r = 9 \text{ m}$

(ii) Volume $V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(9)^3$
 $= 972\pi = 3053.63 \text{ m}^3$

Question 7 (c)

$$\begin{aligned} \text{Combined surface area} &= 9 \times 4\pi(9)^2 \\ &= 2916\pi \\ &= 9161 \text{ m}^2 \end{aligned}$$

MARKING SCHEME NOTES

Question 7 (a) [Scale 15B (0, 4, 15)]

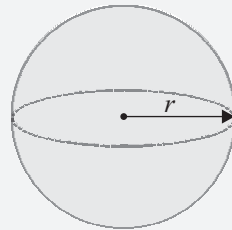
4: Accept any one of the following:

- 16.5×10^{10}
- 165×10^9
- 10^9
- 10^6
- 10^3
- 165 000 000 000
- 1.65

FORMULAE AND TABLES BOOK

Surface area and volume:

Sphere [page 8]



$$A = 4\pi r^2$$

$$V = \frac{4}{3}\pi r^3$$

MARKING SCHEME NOTES

Question 7 (b) (i) [Scale 5B (0, 1, 5)]

1: • Writes answer as $\frac{18}{2}$ or similar

Question 7 (b) (ii) [Scale 5C (0, 1, 2, 5)]

- 1: • Identifies correct volume formula
 • Writes answer from part (b) (i) in this section
- 2: • Formula fully substituted correctly (consistently)
 • One error in substitution followed by correct calculation
 • Answer as 972π

NOTE: $\pi = 3.14$, (3052.08 m³); $\pi = \frac{22}{7}$, (3054.86 m³)

Question 7 (c) [Scale 5C (0, 1, 2, 5)]

- 1: • Identifies correct formula
 • Identifies radius correctly or consistently (in this part)
 • Indicates multiplication by 9
- 2: • Expression fully substituted
 • S.A. of one sphere correctly calculated. (1018 m²)

NOTE: $\pi = 3.14$, (9156 m²); $\pi = \frac{22}{7}$, (9165 m²)

Question 7 (d)

- (i)
- $r = 1.65 \text{ m}$
- ,
- $h = 23 \text{ m}$

$$\begin{aligned}\text{Combined surface areas} &= 8 \times 2\pi(1.65)(23) \\ &= 607.2\pi \\ &= 1908 \text{ m}^2\end{aligned}$$

- (ii)
- $r = 1.45 \text{ m}$
- ,
- $h = ?$

$$\text{Combined surface areas} = 3170 \text{ m}^2$$

$$12 \times 2\pi(1.45)h = 3170$$

$$34.8\pi h = 3170$$

$$\therefore h = \frac{3170}{34.8\pi} = 29 \text{ m}$$

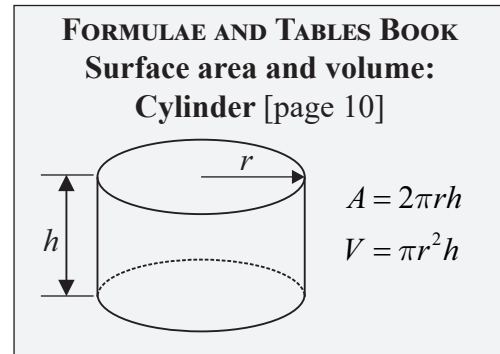
- (iii) Total surface area:

9 spheres + 8 shorter cylindrical pipes + 12 longer cylindrical pipes

$$= 9161 + 1908 + 3170$$

$$= 14\,239 \text{ m}^2$$

$$\text{Cost of painting the Atomium at €70 per square metre} = 14\,239 \times 70 = \text{€}996\,730$$

**MARKING SCHEME NOTES****Question 7 (d) (i) [Scale 5C (0, 1, 2, 5)]**

- 1: • Identifies correct formula
 • Identifies $r = 1.65$ or $h = 23$
 • Indicates multiplication by 8
- 2: • Expression fully substituted
 • Area of one pipe correct

NOTE: $\pi = 3.14$, (1907 m^2) ; $\pi = \frac{22}{7}$, (1908 m^2)

Question 7 (d) (ii) [Scale 15C (0, 3, 5, 15)]

- 3: • $\div 12$ indicated.
 • Identifies correct formula.
 • Indicates $r = 1.45$.
- 5: • Equation fully substituted.

Question 7 (d) (ii) [Scale 5A (0, 5)]